Solar System – Cobra Invitational 2015

TEAM NUMBER: \_\_\_\_\_\_ TEAM NAME: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ STUDENTS: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Match the physical feature with the body with which it is associated:

\_\_\_\_\_1. Cantaloupe Terrain A. Mars Glacial Region

\_\_\_\_\_2. Kuiper Cliff B. Europa

\_\_\_\_\_3. Equatorial Ridge C. Europa

\_\_\_\_\_4. Plages D. Asteroid Belt

\_\_\_\_\_5. Hills Cloud E. Kuiper Belt

\_\_\_\_\_6. Kraken Mare F. Triton

\_\_\_\_\_7. The Piazzi Bright Spot G. Titan’s North Pole

\_\_\_\_\_8. Kirkwood Gaps H. Titan’s South Pole

\_\_\_\_\_9. Baghdad Sulcus I. Earth

\_\_\_\_\_10. Ismenius Lacus Quadrangle J. Sun

\_\_\_\_\_11. Conamara Chaos K. Iapetus

\_\_\_\_\_12. Ontario Lacus L. Ceres

\_\_\_\_\_13. Ion Tail M. Comets

\_\_\_\_\_14. Asthenosphere N. Oort Cloud

\_\_\_\_\_15. Udaeus Lineae O. Enceladus

Refer to Image Set A for Questions 16-39

1. Name the Solar System object in Image A. Write the name of the mission that took this image.
2. Name the Solar System object in Image B. Write the name of the mission that took this image.
3. Name the Solar System object and region of this object pictured in Image C. Write the name of the mission that took this image.
4. Name the Solar System object in Image D. Write the name of the mission that took this image.
5. Name the Solar System object in Image E. Write the name of the mission that took this image.
6. Name the Solar System object in Image F. Write the name of the mission that took this image.
7. Which image was taken from the surface of an object beyond the Asteroid Belt?
8. The probe that took this image landed in what relatively deserted and barren region of the object?
9. What two objects are shown in Image Y?
10. Which image shows the North Pole of this Object?
11. Image G is a composite image comprised of data from which two spacecraft?
12. Which other image shows the same object as Image G?
13. Images M and N show the poles of which object?
14. If red shows higher elevations and blue shows lower elevations, which of these images, M or N, shows the NORTH pole of this object?
15. Which object is shown in Image Z? What is the albedo of the white material? What is the albedo of the dark material?
16. Which object is shown in Image J?
17. The plasma flows around the object depicted in Image J show the effects of what anomalously strong characteristic of this object?
18. Which image shows cratering on this object?
19. Which image shows the planet around which Triton orbits?
20. Triton, along with many other large natural satellites, revolves such that one hemisphere always faces its host planet. What is this phenomenon called?
21. Which image shows Permafrost on the surface of Mars?
22. Which image shows evidence of glaciers on the surface of Mars?
23. Most Earth glaciers are located near the poles. How is this different from evidence of glacial movement left on the surface of Mars?
24. What is the primary constituent of Mars’ atmosphere?

Match the person or man-made satellite with the accomplishment/discovery it made, and write in the year of discovery:

\_\_\_\_\_40. Thrace Macula A. Galileo Galilei

\_\_\_\_\_41. Iapetus Equatorial Ridge B. Giuseppe Piazzi

\_\_\_\_\_42. Ceres C. Galileo

\_\_\_\_\_43. Water jets on Europa D. Cassini Orbiter

\_\_\_\_\_44. Europa E. Surface Science Package

\_\_\_\_\_45. 72-year period comet F. Giovanni Domenico Cassini

\_\_\_\_\_46. Landed on Titan G. Curiosity Rover

\_\_\_\_\_47. Iapetus Color Dichotomy H. Huygens Probe

\_\_\_\_\_48. Liquid Lakes on Titan’s Surface I. Hubble Space Telescope

\_\_\_\_\_49. Triton J. William Lassell

\_\_\_\_\_50. Enceladus’s Magnetic Field K. Cassini Magnetometer

\_\_\_\_\_51. Evidence of Flow in Gale Crater L. David Jewitt & Jane Luu

\_\_\_\_\_52. First Kuiper Belt Objects M. Edmund Halley

1. Write the names of all the currently classified Dwarf Planets in the Solar System.
2. How old is the Solar System? How old is the Universe?
3. What is the name for the period of Solar System activity in which most natural satellites acquired their largest craters?
4. There have been 4 successful Mars Rovers. What are their names?
5. What is the name of the bulge on Mars that may indicate a large impact some 3 billion years ago? What is the name of the large canyon that may have been formed as a result of the same event?
6. Any impact crater left as a result of this collision that caused the dichotomy may have been covered by volcanic activity. However, Olympus Mons, the largest volcano on Mars, only began forming 1 billion years ago. What 3 other large volcanoes overlying the bulge in question **57** are thought to be responsible for covering this hypothesized crater?

Refer to Image Set B for Questions 59-62. For Images P-S, write the name of the mission, the year it was launched, and whether or not it is still in active use (yes/no).

59. Image P

60. Image Q

61. Image R

62. Image S

Match the destination of the mission with its name. On the answer key, write in the year of launch:

\_\_\_\_\_63. Rosetta A. Mars

\_\_\_\_\_64. OSIRIS-REx B. Europa

\_\_\_\_\_65. MER (Spirit & Opportunity) C. 25143 Itokawa

\_\_\_\_\_66. Hayabusa D. 101955 Bennu

\_\_\_\_\_67. JUICE E. 67P Churyumov/Gerasimenko

\_\_\_\_\_68. Europa Clipper F. Jupiter

1. InSight is a mission to Mars proposed to launch in 2016. This mission is different from other missions to Mars in that it will primarily study which area of Mars?
2. The Mars Reconnaissance Orbiter is equipped with a suite including 3 basic types of instruments designed to analyze landforms, stratigraphy, minerals, and ice of Mars, but it does not actually land on the surface. What are these three kinds of instruments?
3. Why is the JUNO Mission set to arrive near Jupiter in 2016 not of direct significance to scientists studying Io, Europa, Ganymed and Callisto?
4. What is the typical sequence of mission types used by NASA to explore a planetary body? Use these terms: Lander, Probe, Flyby, Sample Return Mission, Orbiter, Rover.
5. The Dawn Mission has been launched to study which two large asteroids? What are the names of the other two largest asteroids in the asteroid belt (all four of which comprise nearly half the total mass of the asteroid belt)?
6. Refer to Image V. The distribution of what kind of objects are shown in this graphic?
7. What are the spaces in this distribution called? Which Image, T or U, better shows their relative positions?
8. What do the numbered positions 1, 2, 3, 4, 5 in Image V indicate?
9. The gravitational influence of the objects located at which two numbers from the diagram causes the uneven distribution of objects shown in the graph?
10. Which asteroid could be considered an “embryonic planet” because it was never able to accrete matter to its full potential?
11. This object and others in the asteroid belt were predicted before they were observed due to the “gap” in Solar System Orbital distances where another planet was expected to have formed. What law of ratios in the Solar System predicted its formation in this position?
12. Are Trojans more similar to asteroids or comets? How many Trojans does each planet have?
13. What are the names of the four “families” or Near Earth Asteroids?
14. Most asteroids can be divided into C, M, or S types based on composition. What do each of these letters stand for?
15. Refer to Image DD. Label the parts of a comet on your answer sheet.
16. Which three lettered regions of Image EE represent the “Planetary Boundary”, “Kuiper Belt”, and “Inner Oort Cloud”, respectively?

Match the suspected composition of the subsurface ocean with the body it is associated with:

\_\_\_\_\_85. Ceres A. various salts H20

\_\_\_\_\_86. Triton B. NH3, H20

\_\_\_\_\_87. Titan C. H202, H20

\_\_\_\_\_88. Europa D. NaCl, H20

\_\_\_\_\_89. Enceladus E. C2H6, CH4, H20

1. Which object from the rules has the highest average surface temperature?
2. Which object from the rules contains the highest hypothesized amount of liquid water?
3. Which object from the rules has a surface pressure most similar to that of Earth?
4. Which object in the from the rules has the highest albedo? What is it?
5. The presence of what substance on Titan allows some water to remain liquid down to -97 C, a “eutectic” condition?
6. The Earth’s atmosphere has 5 layers: exosphere, thermosphere, stratosphere, mesosphere, and troposphere. Which of these two are also found in Titan’s atmosphere?
7. What do the green regions in Image H indicate?
8. What does the fine green line in Image H indicate?
9. The snowflake symbols in Image H indicate the location of what boundary for each star system?
10. Which 4 chemicals are considered the “building blocks of life”?
11. Which object has an atmosphere thick enough and low enough surface gravity that a human being

could fly using prosthetic wings?

1. The Earth is transported to be 4 AU from the Sun. What is the ratio of the total solar flux the Earth

receives from the Sun before it is moved to after it is moved?

1. A satellite in synchronous rotation orbits around its host planet with a period of 19 days. What is the

period of radial rotation of the satellite?

1. An Amor asteroid is the solar system orbits the Sun at an average distance of 4 AU. What is its period in

years?

1. What is the name for the relatively radio-quiet band between 18 and 21 cm lines in the radio region of

the electromagnetic spectrum thought for several reasons to be a key band for detection of signals

indicating extraterrestrial life?

1. Look at Image GG, a phase diagram of Carbon Dioxide. What physical state would water be in when

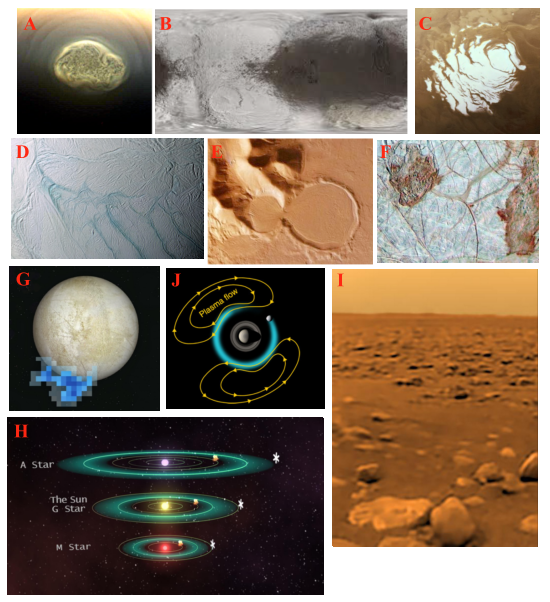
Carbon Dioxide is at its triple point?

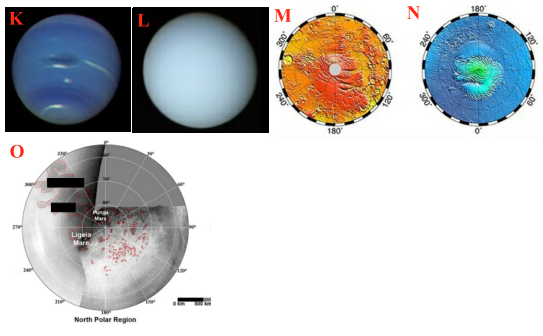
1. The surface spectrum of an object from the rules is shown in magenta in Image II. Based on the

comparison spectra shown in Image HH, what does the blue line represent the spectrum of?

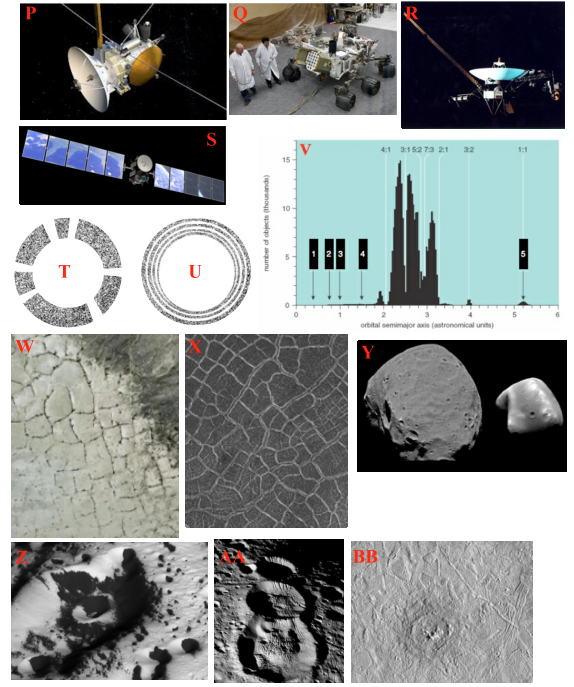
1. Which two objects might the magenta line be the surface spectrum of?

**IMAGE SET A**

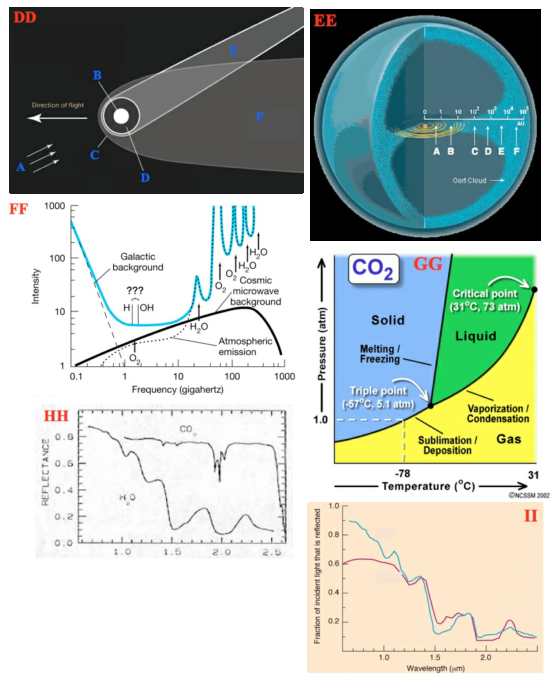




**IMAGE SET B**

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**IMAGE SET C**

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